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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/085,183	02/27/2002	Wen-Chun Zheng	03226.111001;P6259	1430
32615	7590	04/15/2004	EXAMINER	
OSHA & MAY L.L.P./SUN 1221 MCKINNEY, SUITE 2800 HOUSTON, TX 77010			CHU, CHRIS C	
			ART UNIT	PAPER NUMBER
			2815	

DATE MAILED: 04/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/085,183

Applicant(s)

ZHENG ET AL.

Examiner

Chris C. Chu

Art Unit

2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 January 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 - 17 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1 - 17 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. Applicant's amendment filed on January 16, 2004 has been received and entered in the case.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1 - 4, 9 – 12 and 17 are rejected under 35 U.S.C. 102(e) as being anticipated by Nagarajan et al. '499.

Regarding claims 1 and 9, Nagarajan et al. discloses in e.g. Fig. 2 and column 2, lines 16 – 67 a flip-chip package assembly comprising:

- a package substrate (120) having a mounting surface;
- a semiconductor die (202) mounted on a first portion (e.g., the area under the die 202) of the mounting surface;
- a heat removal device (104; e.g., copper) physically secured to a second portion (an area under the elements (118) and any place other than the first portion) of the

mounting surface by an attachment (118; adhesive e.g., bisphenol) means formed of a material different than a material of the heat removal device, wherein a height of the attachment means extends from the second portion to past a height of the semiconductor die; and

- a thermal interface material (114) disposed between the semiconductor die and the heat removal device.

Regarding claims 2 and 10, Nagarajan et al. discloses in e.g. Fig. 2 and column 2, lines 34 – 40 the heat removal device being a heat sink.

Regarding claims 3 and 11, Nagarajan et al. discloses in e.g. Fig. 2 and column 2, lines 16 – 67 the attachment means being an adhesive (118).

Regarding claims 4 and 12, Nagarajan et al. discloses in e.g. Fig. 2 the adhesive (118) being disposed at a plurality of discrete locations on the second portion of the mounting surface.

Regarding claim 17, Nagarajan et al. discloses in e.g. Fig. 2 and column 2, lines 16 – 67 a flip-chip package assembly, comprising:

- supporting means for providing support (120) to a semiconductor die (202);
- heat removal (104) means for dissipating heat from the semiconductor die;
- interfacing means (114) for transferring heat from the semiconductor die to the heat removal means; and
- attaching means (118) for attaching the heat removal means to the supporting means,
- wherein a height of the attaching means extends from the supporting means to past a height of the semiconductor die (see Fig. 2).

4. Claims 1 - 3, 6, 9 – 11, 14 and 17 are rejected under 35 U.S.C. 102(e) as being anticipated by Barber et al. '292.

Regarding claims 1 and 9, Barber et al. discloses in e.g. Fig. 3, column 5, lines 42 – 45 and column 6, lines 1 – 40 a flip-chip package assembly comprising:

- a package substrate (100) having a mounting surface;
- a semiconductor die (130) mounted on a first portion (e.g., the area under the die 130) of the mounting surface;
- a heat removal device (150; e.g., copper) physically secured to a second portion (an area under the elements (160) and any place other than the first portion) of the mounting surface by an attachment (118; adhesive e.g., epoxy) means formed of a material different than a material of the heat removal device, wherein a height of the attachment means extends from the second portion to past a height of the semiconductor die; and
- a thermal interface material (140) disposed between the semiconductor die and the heat removal device.

Regarding claims 2 and 10, Barber et al. discloses in e.g. Fig. 3 and column 5, lines 42 – 45 the heat removal device being a heat sink.

Regarding claims 3 and 11, Barber et al. discloses in e.g. Fig. 3, column 5, lines 42 – 45 and column 6, lines 1 – 40 the attachment means being an adhesive (160).

Regarding claims 6 and 14, Barber et al. discloses in e.g. Fig. 3 and column 5, lines 42 – 43 the thermal interface material (140) being thermal grease.

Regarding claim 17, Barber et al. discloses in e.g. Fig. 3, column 5, lines 42 – 45 and column 6, lines 1 – 40 a flip-chip package assembly, comprising:

- supporting means for providing support (100) to a semiconductor die (130);
- heat removal (150) means for dissipating heat from the semiconductor die;
- interfacing means (140) for transferring heat from the semiconductor die to the heat removal means; and
- attaching means (160) for attaching the heat removal means to the supporting means,
- wherein a height of the attaching means extends from the supporting means to past a height of the semiconductor die (see Fig. 3).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 5 – 8 and 13 – 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagarajan et al. in view of Sherif et al. '729.

Nagarajan et al. discloses the semiconductor package set forth in the claims except for the adhesive comprising eutectic solder paste (claims 5 and 13); the thermal interface material being selected from the group consisting of low melt solder phase change material, thermal tape and thermal grease (claims 6 and 14); a bottom surface of the heat removal device comprising at least one recess for accommodating the semiconductor die (claims 7 and 15); and the bottom surface

of the heat removal device further comprising at least one recess for accommodating at least one electrical component mounted on the second portion of the mounting surface (claims 8 and 16). Sherif et al. teaches in e.g., Fig. 2, column 6, lines 13 - 14 and column 6, line 43 the adhesive comprising eutectic solder paste; the thermal interface material being selected from the group consisting of low melt solder phase change material, thermal tape and thermal grease; a bottom surface of the heat removal device comprising at least one recess (33, at the left) for accommodating the semiconductor die; and the bottom surface of the heat removal device further comprising at least one recess (e.g., any other recess 33, such as the rightmost recess) for accommodating at least one electrical component (e.g., a second die) mounted on the second portion of the mounting surface. Thus, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to modify Nagarajan et al. by using the eutectic solder paste for the adhesive, the thermal interface material to be the thermal grease, the recesses at the bottom surface of the heat removal device for the semiconductor die and other electrical component as taught by Sherif et al. The ordinary artisan would have been motivated to modify Nagarajan et al. in the manner described above for at least the purpose of (1) increasing performance and reliability by providing the shortest and most efficient thermal cooling path for the die (column 1, lines 43 – 56), (2) providing a cushion (thermal grease) which accommodates aspires, tolerances and thermal expansions between chips and heat sink and (3) providing better thermal performance at a lower cost because the thickness of the paste filled gap is small, there are fewer interfaces for the heat to cross, and it is insensitive to chip pitch (column 2, lines 5 - 15).

7. Claims 5, 7, 8, 13, 15, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barber et al. in view of Sherif et al. '729.

Barber et al. discloses the semiconductor package set forth in the claims except for the adhesive comprising eutectic solder paste (claims 5 and 13); a bottom surface of the heat removal device comprising at least one recess for accommodating the semiconductor die (claims 7 and 15); and the bottom surface of the heat removal device further comprising at least one recess for accommodating at least one electrical component mounted on the second portion of the mounting surface (claims 8 and 16). Sherif et al. teaches in e.g., Fig. 2, column 6, lines 13 - 14 and column 6, line 43 the adhesive comprising eutectic solder paste; a bottom surface of the heat removal device comprising at least one recess (33, at the left) for accommodating the semiconductor die; and the bottom surface of the heat removal device further comprising at least one recess (e.g., any other recess 33, such as the rightmost recess) for accommodating at least one electrical component (e.g., a second die) mounted on the second portion of the mounting surface. Thus, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to modify Barber et al. by using the eutectic solder paste for the adhesive, the recesses at the bottom surface of the heat removal device for the semiconductor die and other electrical component as taught by Sherif et al. The ordinary artisan would have been motivated to modify Barber et al. in the manner described above for at least the purpose of (1) adjusting the chip temperatures by varying the depth of the gap between the chip and the heat sink and (2) providing different thermal conductivity materials on the different chips (column 5, lines 25 - 54).

Response to Arguments

8. Applicant's arguments with respect to claims 1, 9 and 17 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

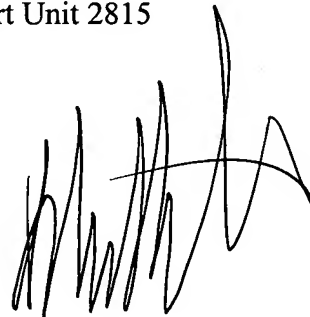
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chris C. Chu whose telephone number is 571-272-1724. The examiner can normally be reached on 11:30 - 8:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 517-272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Chris C. Chu
Examiner
Art Unit 2815

c.c.
4/8/04 10:43:08 PM

A handwritten signature in black ink, appearing to read 'BRADLEY BAUMEISTER', with a large, stylized flourish at the end.

BRADLEY BAUMEISTER
PRIMARY EXAMINER